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AUTHOR Bridges, Edwin M.; Hallinger, Philip
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ABSTRACT

A proposal that calls for increasing the relevance of administrator preparation by applying a problem-based learning approach is offered in this paper. A review of literature on problem-based learning (PBL) in medical education concludes that, compared with traditional programs, PBL yields superior or equivalent results on a variety of outcome measures. Eight design issues for PBL programs are identified next: incorporation of PBL into the curriculum; selection and definition of problems; identification of goals for educational administrators; components of small learning groups; the extent of program pre-structuring; evaluation; student orientation; and faculty preparation. A research agenda is proposed to determine the effectiveness of the various species of PBL in achieving the different goals of managerial education. Criteria for measuring independent and dependent variables are also suggested. Encouragement is offered to educators to tackle the challenges inherent in moving from a traditional to PBL approach. (28 references) (LMI)

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Problem-Based Learning in Medical and Managerial Education

by

Edwin M. Bridges and Philip Hallinger[1]

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The preparation of school administrators currently occupies centerstage on the intellectual agenda of professors and departments of educational administration (Griffiths, Stout and Forsyth, 1988). One manifestation of this new found interest in preparing administrators is a proposal to increase the relevance of preparation by orienting it more explictly to problems of practice. This proposal, like many others, lacks specificity and skirts the issue of whether it is supported by theory, research, or both.

The present chapter seeks to fill this gap by drawing on the problem-based learning (PBL) literature in the field of medical education. As we shall see, medical educators throughout the world use problem-based learning to train physicians. Moreover, medical educators have studied this instructional approach extensively. Their experience offers us a unique opportunity to build on and go beyond what they have learned as we apply this promising approach to preparing educational administrators.[2]

Problem-based Learning in Medical Education

Problem-based learning is used in more than 80 percent of the medical schools in the United States (Jonas, Etzel and Barzansky, 1989) and has five defining characteristics:

1. The starting point for learning is a problem.
2. The problem is one that students are to apt face as future physicians.
3. Subject matter is organized around problems rather than the disciplines.
4. Students assume a major responsibility for their own instruction and learning.
5. Most learning occurs within the context of small groups rather than lectures.

Apart from these five common features, problem-based learning curricula in medical schools vary along the following two dimensions: (1)the program's major goals (e.g., knowledge acquisition and use, problem-solving skills, and self-directed learning skills) and (2)the extent to which the instructors or the students choose the learning objectives, resources, and modes of student evaluation.

Rationale

Medical educators justify using problem-based learning on grounds which, in our judgment, apply with equal force to the preparation of school administrators. First, medical educators contend and buttress their contention with empirical evidence that medical students retain little of what they learn in the basic disciplines (Bok 1989). Second, medical educators cite research which shows that students in medicine and a host of other fields often do not appropriately use the knowledge which they have learned (Schmidt 1983). (We suspect that researchers in the field of educational administration would find similar results in both instances.) Third, since students forget much of what is learned or use their knowledge inappropriately, instructors should create conditions that optimize retrieval and appropriate use of the knowledge in future professional practice.

Fourth, PBL creates the three conditions which information theory links to subsequent retrieval and appropriate use of new information (Schmidt, 1983):

a. Prior knowledge is activated, i.e., students apply knowledge they already possess in order to understand the new information. This prior knowledge and the kind of structure in which it is stored determine what is understood from the new experience and what is learned from it. Problems are selected and sequenced to ensure that this activation of prior knowledge occurs.

b. The context in which information is learned resembles the context in which it will later be applied (referred to as encoding specificity). Research shows that knowledge is much more likely to be remembered or recalled in the context in which it was originally learned (Godden and Baddeley, 1975). Encoding specificity in problem-based learning is achieved by having students acquire knowledge in a functional context, i.e., in a context containing problems that closely resemble the problems which they will encounter later in their professional career.

c. Information is better understood, processed and recalled if students have an opportunity to elaborate on that information. Elaborations provide redundancy in the memory structure which in turn reduces forgetting and abets retrieval. Elaboration occurs in problem-based learning in various ways, namely, discussing the subject matter with other students, teaching peers what they first learned themselves, exchanging views about how the information applies to the problem they are seeking to solve, and preparing essays about what they have learned while seeking to solve the problem.

Fifth, PBL explicitly forces students to adopt a problem-solving orientation when learning new information.

> The advantage of such an approach is that students become much more aware of how the knowledge they are acquiring can be put to use. Adopting a problem-solving mentality, even when it is marginally appropriate, reinforces the notion that the knowledge is useful for achieving particular goals. Students are not being asked to store information away; they see how it works in certain situations which increases the accessibility. (Prawat, 1989, p. 18.)

Finally, the disciples of PBL stress the motivational value of the approach. They maintain that students enjoy the opportunity to play the role of doctor during their preclinical training and find the activity of working on simulated patient problems intrinsically rewarding.

Empirical evidence

Although medical educators present a rather persuasive rationale for using PBL to train a physician, do they provide any evidence that the approach is a sound one? **Yes, compared with traditional programs in medical education, PBL programs generally yield equal or superior results**. The results are summarized below.

Students in PBL programs express substantially more positive attitudes toward their

training than do students in more traditional programs. The former praise their training, especially those aspects which are unique to problem-based learning, while the latter often describe their training as boring, irrelevant, and anxiety-provoking (deVries, Schmidt, and deGraaff, 1989; and Schmidt, Dauphinee, and Patel, 1987).

Besides expressing more favorable attitudes toward their education, students in PBL programs also adopt more desirable approaches to studying than their traditional program counterparts. PBL students are more likely to adopt a meaning orientation to studying, i.e., to be intrinsically motivated by the subject matter and to strive to understand the material. Students in traditional programs, on the other hand, are more likely to adopt a reproducing orientation to studying, i.e., use rote learning and seek to reproduce the factual information in the syllabus (Coles, 1985; deVolder and deGrave, 1989; Schmidt, Dauphinee, and Patel, 1987).

These differences in attitudes and approaches to studying also translate into differences in rates and time of completion. In countries with relatively high dropout rates among medical students, students in PBL programs are much more likely to graduate and to complete their programs of study in less time than students in traditional programs (deVries, Schmidt, and deGraaff, 1989).

Students in PBL programs also tend to perform better than students in conventional programs on measures of problem solving proficiency and clinical competence (deVries, Schmidt, and deGraaff, 1989; Jones, et al., 1986; Kaufman, et al., 1989; and Schmidt, Dauphinee, and Patel, 1987). However, we should note that the performance differences are small and that the outcome measures vary in quality.

When medical knowledge is considered, the pattern of differences reverses itself. Students in conventional programs score slightly higher on standardized tests of medical knowledge than students in PBL programs (Schmidt, et al., 1989; deVries, Schmidt, and

deGraaff, 1989; and Kaufman, et al., 1989). The differences are small enough that they are of little practical importance.

Limitations of the research on PBL

The research that has been conducted on the effectiveness of problem-based learning versus the traditional approach is flawed in several respects. Let us examine the deficiencies of this research in terms of the specification of the independent variable and the measurement of dependent variables.

Independent variable. Although researchers claim that they are contrasting problem-based learning with traditional training programs, their claims are suspect. There are virtually no attempts to define what is meant by "traditional." Moreover, when problem-based learning is compared with the traditional approach, PBL often is not the main instructional approach. In those cases where PBL appears to be the main approach and is explicitly defined, it is clear that the PBL programs belong to the same genus but different species.

Measures of the dependent variables. The measures of the dependent variables, like the specification of the independent variable, are also suspect. Researchers rarely cite any evidence that attests to the reliability of the measures. In those rare instances where the researcher supplies data about reliability (Imbos, et al., 1984; deVolder and deGrave, 1989), the coefficients are moderate at best (.26 to less than .80).

When measuring differences in medical knowledge (e.g., deVries, Schmidt, and deGraaff, 1989; Jones, et al., 1984; and Kaufman, et al., 1989), researchers appear to be testing recall via cued questions (i.e., alternative answers furnished), rather than recall and spontaneous use of knowledge in clinical contexts. Given the rationale for problem-based learning in medical education, it seems more appropriate to measure how well students retrieve and correctly use knowledge in clinical contexts without external prompts (Claessen and

Boshuizen, 1985).

Unlike medical knowledge, problem-solving proficiency is measured in the context of patient problems. Researchers supply medical students with bits of information about patients and then ask the students to reproduce as much of this information as possible. Their proficiency in problem-solving is assessed in terms of how many items of information they correctly recall and the degree to which the information is structured or randomly reproduced. This mode of assessment represents a limited measure of problem-solving proficiency--efficiency in encoding and chunking information that is used in solving problems.

Designing Problem-Based Learning Programs for Educational Administrators

As we have indicated, there is ample, though not conclusive, evidence that PBL equals or is superior to traditional instructional approaches in producing desirable outcomes for medical education. In light of these promising results, we think it is important to experiment with different forms of problem-based learning in preparing administrators. To facilitate this experimentation, we have identified eight major design issues that represent possibilities for developing and studying different PBL program designs. In the discussion that follows we discuss these various issues and what we have learned about them through our reading and our own efforts at Stanford and Vanderbilt Universities to prepare aspiring and practicing administrators using PBL.

Issue 1: How should PBL be incorporated into the curriculum? There are at least four different ways PBL can be incorporated into the curriculum for preparing educational administrators (1)PBL can be used as the main instructional approach for the entire curriculum; (2)the curriculum can consist of two tracks with one of these tracks using PBL as the main approach; (3)one or more courses in the curriculum can be organized around

problem-based learning; and (4)a portion of one or more courses can use PBL.

The first alternative appears to be the least desirable choice for several reasons. Although students apparently enjoy the approach, it is clear that some students prefer a more traditional learning format (Jones, et al., 1984). Other students like the variety reflected in programs employing both traditional and PBL approaches. Instructors, like students, differ in their preferences for traditional and problem-based learning. These differences may lead to needless, destructive conflict within departments of educational administration. Finally, problem-based learning, though a promising alternative, remains an unproven method in preparing educational administrators. Since its effectiveness remains in doubt, trials on a more limited basis seem warranted.

Issue 2: What problems should be used, and how should they be presented? Since problems are one of the defining characteristics of the genus, PBL, program designers need to devote considerable time and thought to this second issue. When choosing focal problems for the PBL curriculum, one or more of the following criteria may be used: (1) prevalence (i.e., the problem is a common one); (2) integrative value (i.e., the problem is suitable for studying concepts from a range of disciplines); (3) prototypic value (i.e., the problem, though rare, is an excellent model for study); (4) high potential impact (i.e., the problem threatens large numbers of people for an extended period of time); and (5) lack of structure (i.e., the problem is a "swamp" with many issues and sub-issues).

When presenting the focal problems to students, these problems can be presented as a written case, a live role play, an interactive computer simulation, interactive videodisc, or a taped episode. Sole reliance on written cases or verbal vignettes, as Bransford, et al. (1989) have noted, may have dysfunctional consequences for the learner. In order to become an expert, a great deal of perceptual learning must occur and this cannot happen unless the student learns to recognize the salient visual, auditory, and non-verbal cues. When

designing a PBL curriculum, program designers should strive for a variety of modalities in presenting problems to educational administrators. If students encounter only verbal descriptions of problems, they may be unprepared to deal with real problems.

Issue 3: What should be the goals of problem-based learning for educational administrators? There are at least four major goals which may lie at the heart of problem-based learning: (1)acquisition of retrievable and usable knowledge; (2) problem-solving skills; (3)administrative skills; and (4)self-directed learning skills. Since most profesors of educational administration are quite familiar with the rationale for the first three goals, we will limit our discussion to the goal of self-directed learning skills. This goal rarely surfaces in discussions of curriculum in our field; moreover, it represents the most important and problematic choice for PBL designers.

The rationale underlying the need for self-directed learning skills is straightforward. The knowledge base that undergirds professional practice is vast and continually undergoing change. If professionals are to keep abreast of this knowledge base, they need to acquire skills in learning how to learn. These self-directed learning skills include: proficiency in identifying one's own learning needs and objectives; skill in locating and evaluating resources (reference material and expert advice); competence in applying the knowledge to professional problems; and skill in self-evaluation.

The decision to make self-directed learning skills a major goal is a crucial design decision. If designers decide to emphasize these skills, many of the subsequent design decisions will made by the student, rather than by the instructional staff. These design decisions include the specific learning objectives, the relevant resources, and the modes of evaluation. When designers turn these decisions over to students, two risks arise. First, there is limited evidence that students select learning objectives which do not always correspond to the ones envisioned by the instructional staff (who, in turn, may be responding to the program

requirements of state accreditation agencies). There is some overlap, but it is less than perfect. Second, when given the opportunity to define their own learning needs and resources, students, in our experience, may transform PBL into a library research project. If this happens, students devote more time and effort to summarizing what they have learned, rather than to applying the knowledge to the focal problem.

Issue 4: How should the small learning groups be constituted? One of the defining characteristics of PBL is that the primary learning format is a small group. These small groups may be constituted as a tutorial (Barrows, 1984), a cooperative learning group (Slavin, 1989), or a project team. Our experience, thus far, leads us to favor constituting the small group as a project team, but the other two ways remain viable choices.

Each project team consists of five to seven students; the instructor is not a member of the team but serves as a resource to it. Since administrators frequently administer projects, the small group affords students with an opportunity to develop an array of skills associated with project management. Most notably, students learn skills in planning how to accomplish the project's goals in a fixed period of time with existing resources. In addition, students learn what is involved in shouldering responsibility for carrying out a plan with the members of a project team. By varying the goals, the composition of the team, the leader, and the duration of the project, PBL designers are able to expose students to the situational nature of leadership and the risk and the uncertainty that are characteristic of managerial work. Project meetings also provide opportunities for students to acquire competence in running meetings, a major medium of managerial work.

Issue 5: How much should each focal problem (or problem based learning project) be pre-structured? When designing a PBL program for educational administrators, designers may elect to provide varying amounts of pre-structuring for each focal problem or project. At one extreme, the designer may supply only the problem and

permit students to define the rest of the structure (i.e., the learning objectives, the resources, and the mode of evaluation). At the other extreme, the designer may provide the problem and specify the learning objectives, resources, guiding questions (either to highlight certain concepts or to help the student analyze the problem), and mode of evaluation. Between these two extremes, the designer can vary the degree of pre-structuring by allowing students to decide one or more of the following: learning objectives, learning resources, and mode of evaluation.

How much pre-structuring occurs depends upon two factors. The first factor involves the major goals of the program. If the designer wishes to emphasize self-directed learning skills, each project is likely to reflect a minimal amount of pre-structuring. If, however, the designer attaches little or no importance to self-directed learning skills, each project is apt to be highly pre-structured. A second factor relates to the availability of resources; the less students have easy access to a library and relevant experts, the greater the need for pre-structuring the learning objectives and resources.

Even if the designer elects to emphasize self-directed learning skills, it is important to pre-structure the focal problems or projects during the early stages. Students find it difficult to make the transition to a problem-based learning program, and the transition is sometimes slow. Accordingly, projects need to be pre-structured at the outset with the amount of pre-structuring being gradually reduced as students become more comfortable and more familiar with problem-based learning.

Issue 6: What form should evaluation take in the context of problem-based learning? When grappling with this issue, designers need to distinguish between program and student evaluation and between formative and summative evaluation. In the early stages of implementing PBL, we have found it valuable to emphasize formative evaluation. Despite our efforts to create units that are flawless from the outset, we inevitably learn from

the initial field tests of these projects. Student feedback, supplemented by our own observations, leads to revision. In some cases these revisions are substantial. The second trial of the unit or project generally results in little or no revision. Once the problem-based learning projects have been field-tested and debugged, it is appropriate and desirable to conduct summative evaluations.

When conducting formative or summative evaluations of student performance, designers may use one or more methods to assess the quality of a student's performance. The most commonly used methods in medical education are self-evaluation, peer evaluation, and instructor evaluation. We have followed the practices used in medical education and have used all three methods to evaluate student performance.

Issue 7: How should students be prepared to function effectively in a problem-based learning instructional environment? As we have noted, students encounter difficulty in making the transition from a traditional to a problem-based learning environment. Medical educators have alluded to these difficulties, and we have observed them as we have worked with aspiring and practicing administrators. If designers properly attend to transitional issues, they can reduce the stress experienced by students and can accelerate their successful adjustment to this instructional approach.

To ease the students' transition to a problem-based learning environment, designers have several options. Besides extensively pre-structuring the first few problem-based units, designers can provide students with an orientation to problem-based learning and with some of the foundational skills the process requires. Based on our experience, we have found it helpful to orient students by describing PBL in relation to the following questions: What is problem-based learning? What is the underlying rationale for PBL? How will PBL be incorporated into their training? What are the major goals? How will the learning groups be constituted? How will students be evaluated? In other words, students need to

know how the instructional staff has decided to resolve the various design issues.

The students' transition to PBL can also be facilitated by providing them with training in the kinds of skills which they will need to succeed in a problem-based curriculum. For the most part, these skills are the same ones which they will need when they become administrators--skills in project and meeting management, problem-solving, conflict resolution, and oral and written communication. Acquisition of these skills is enhanced through their repeated use in the problem-based learning units. Depending upon the major goals of the curriculum, students may also need training in locating and evaluating relevant published materials.

Issue 8: How should faculty be prepared to function effectively in a problem-based learning environment? Even if faculty members favor using a problem-based learning approach, they are likely to encounter difficulty in making the transition. The vast majority of faculty members have been prepared in disciplinary-based programs that rely heavily on two methods--the lecture and instructor-led discussions. Having limited or no exposure to the problem-based approach, faculty members understandably will lack some of the basic knowledge and skills needed to design a PBL program and to implement it successfully. Under these conditions, it is important to provide formal training in designing and implementing PBL and to create settings in which instructors can share their difficulties and discuss ways of dealing with them.

PBL: A Future Research Agenda

Since problem-based learning is a promising, but unproven, approach for preparing educational administrators, it represents a potentially fruitful area for investigation. To stimulate interest in studying this instructional approach, we will suggest some directions that research on problem-based learning might take.

Proposed Focus

In our judgment, the educational administration research community should re-frame the basic question asked by researchers in medical education. As we indicated earlier, medical educators generally seek to answer some form of the following question: Do problem-based learning programs produce significantly better outcomes for medical students than traditional programs? A more appropriate and potentially more illuminating question is as follows: How effective are the various species of PBL in achieving the different goals of managerial education?

This particular question is more desirable for several reasons. First, this formulation recognizes that there is no agreement among PBL supporters about what problem-based learning means. Second, this formulation acknowledges that we do not currently understand which elements of PBL or combination of elements are effective in achieving different types of educational goals. This important issue continues to baffle medical educators because of the way in which they have posed their basic research question. Finally, this way of framing the question is less divisive because it does not pit advocates of PBL against the proponents of more established, traditional approaches. As a result, there is likely to be a greater willingness within departments of educational administration to experiment with problem-based learning.

Independent Variables

Program evaluators do not commonly "describe fully, let alone measure, how the programs in 'experimental' and 'control' situations actually differ from one another--or even to certify that they do." (Charters and Jones, 1975, p. 342) We noted this phenomenon in the research on PBL in medical education and pointed out the consequences, namely, the uninterpretability of the results.

In light of what Charters and Jones have noted and what we have observed during our

review of research on PBL, we fear that history may repeat itself. To prevent this from happening, PBL researchers in the field of educational administration should specify which species of PBL they are studying. As we have indicated earlier in this paper, these species can be described in terms of how the faculty chose to resolve each of the eight design issues which we highlighted. In addition, researchers should certify that the PBL programs actually operated as they were described. Descriptive studies of how one or more elements (e.g., the small learning groups and the role of the instructor) in the PBL design was implemented would be especially informative.

Dependent Variables

The choice of dependent variables depends primarily on the major goals of the program. PBL programs may, as we have noted, emphasize one or more of the following goals: retrievable/usable knowledge, problem-solving skills, administrative skills, and self-directed learning skills. We will limit our discussion to the two goals which have received the greatest attention by medical researchers, namely, knowledge and problem-solving skills.

In studying the degree to which the knowledge goal has been accomplished, researchers could profitably follow the lead of Bransford, et al.(1989). These cognitive psychologists have studied the spontaneous use of knowledge by college students who acquired information under problem-processing and fact-processing instructional formats. Students who learned the information under a problem-processing format were much more likely to use this information spontaneously in developing action plans than students taught the same information in a fact-processing format. Bransford's work provides a potentially fruitful approach to studying knowledge use and suggests that one or more versions of problem-based learning is likely to be effective in promoting the retrieval and use of knowledge. Alternatively, researchers might examine knowledge retrieval and use in

clinical contexts (e.g., internship or on-the-job).

Studying the effects of PBL on administrator problem-solving skills represents a more formidable challenge. "There are no simple tricks to assessing problem-solving skills." (McGuire, 1980, p. 122) The absence of a single yardstick for assessing problem-solving proficiency leads us to propose several approaches to this important, but admittedly complex, task. What the intellectual yield will be from these various approaches remains a mystery.

Medical educators have tended to assess the effectiveness of problem-solving skills by examining the efficiency of medical students in encoding and chunking information gleaned from simulated patient problems. If this approach were used in the field of educational administration, researchers would ask students to read a case and then to write down all the information they can remember. The efficiency of students in processing the information contained in the case could be gauged by scoring (a)the number of correctly reproduced items of information in the student's recall protocol and (b)the degree to which similar items are grouped together. This approach allows insight into the content and structure of the student's relevant knowledge base, a crucial factor in the ability to solve problems (Claessen and Boshuizen, 1985).

A second approach to studying problem-solving skills is suggested by the work of cognitive psychologists. There is some evidence that knowledge of general mental strategies remains inert, i.e., used only in a restricted set of contexts even though they are applicable in a wide variety of domains (Bransford, et al., 1986). In view of this possibility, researchers may find it fruitful to examine the extent to which graduates of PBL programs spontaneously use the general problem-solving strategies which they acquired during their training.

Another approach might focus on the proficiency of those individuals who

spontaneously use their newly acquired general problem-solving strategies. Studies of clinical reasoning reveal "that physicians often fail to collect the data they need, to pay attention to the data they do collect,...and to incorporate a systematic consideration of alternative risks and values in the actions they take."(McGuire, 1985, p. 594)

Administrators are also likely to reveal disquieting defects in their problem-solving processes. Based on our experience, we anticipate that students may bog down as they try to define messy, ill-structured problems and may overlook the need to anticipate the problems and obstacles which may arise when they implement a chosen course of action.

The adequacy of an administrator's problem-solving skills can also be assessed by examining the outcomes. A key assumption underlies the emphasis on general problem-solving strategies, namely, the use of these strategies leads to higher quality decisions and outcomes. This assumption needs to be tested. One way of testing it is by looking at the degree of post-decisional regret that accompanies major decisions (Janis and Mann, 1977). Presumably, a person who lacks proficiency in using problem-solving strategies when making consequential decisions will experience more post-decisional regret than one who possesses this proficiency.

Summary and Conclusion

According to the critics, current programs for preparing educational administrators are inadequate and should be overhauled. These same critics propose a number of solutions to improve these preparatory programs. One of these proposals calls for increasing the relevance of administrator preparation by making it more problem-based. This proposal, sensible on its face, offers the profession a unique opportunity to build on the work of educators in other fields who are using problem-based learning (PBL) to train practitioners.

To capitalize on this opportunity, we have reviewed the literature on PBL in medical education. Our review highlights the rationale for this approach and reveals that PBL,

compared with traditional programs in medical education, yields superior or equivalent results on a variety of outcome measures. Based on this review and our own personal experiences with PBL, we have identified eight major design issues which confront those who desire to use problem-based learning in preparing educational administrators. We have also proposed a research agenda aimed at increasing the field's understanding of the effectiveness of PBL in educating school administrators.

Hopefully, our discussion will stimulate others to tackle the intellectual challenges inherent in moving from a traditional to a problem-based learning approach. Those who do rise to confront these challenges are likely to experience the same kind of excitement and renewed fervor for teaching that we and others have experienced.

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1. Edwin Bridges is Professor of Education in the School of Education, Stanford University. Philip Hallinger is Associate Professor of Education and Director of the Center for the Advanced Study of Educational Leadership in Peabody College. Work on this project was supported by grants from the Walter S. Johnson Foundation and the Danforth Foundation. This paper will appear in the volume, *Cognitive Perpectives on School Leadership*: New York: Teachers College Press, forthcoming 1993.

2. See E. Bridges with assistance of P. Hallinger, Problem-Based Learning for Administrators (Eugene, Oregon: ERIC Clearinghouse for Educational Management, 1992) for numerous examples of how PBL may be incorporated into a curriculum for preparing administrators.